INDIANA
DEPARTMENT *of*
EDUCATION

2023 INDIANA ACADEMIC STANDARDS
MATHEMATICS

GRADE 5

Indiana Academic Standards Context and Purpose

Introduction

The Indiana Academic Standards for Grade 5 Mathematics are the result of a process designed to identify, evaluate, synthesize, and create high-quality, rigorous learning expectations for Indiana students.

Pursuant to Indiana Code (IC) 20-31-3-1(c-d), the Indiana Department of Education (IDOE) facilitated the prioritization of the Indiana Academic Standards. All standards are required to be taught. Standards identified as essential for mastery by the end of the grade level are indicated with shading and an "E." The learning outcome statement for each domain immediately precedes each set of standards.

The Indiana Academic Standards are designed to ensure that all Indiana students, upon graduation, are prepared with essential knowledge and skills needed to access employment, enrollment, or enlistment leading to service.

What are the Indiana Academic Standards and how should they be used?

The Indiana Academic Standards are designed to help educators, parents, students, and community members understand the necessary content for each grade level, and within each content area domain, to access employment, enrollment, or enlistment leading to service. These standards should form the basis for strong core instruction for all students at each grade level and content area. The standards identify the minimum academic content or skills that Indiana students need in order to be prepared for success after graduation, but they are not an exhaustive list.

While the Indiana Academic Standards establish key expectations for knowledge and skills and should be used as the basis for curriculum, the standards by themselves do not constitute a curriculum. It is the responsibility of the local school corporation to select and formally adopt curricular tools, including textbooks and any other supplementary materials, that align with Indiana Academic Standards. Additionally, corporation and school leaders should consider the appropriate instructional sequence of the standards as well as the length of time needed to teach each standard. Every standard has a unique place in the continuum of learning, but each standard will not require the same amount of time and attention. A deep understanding of the vertical articulation of the standards will enable educators to make the best instructional decisions. These standards must also be complemented by robust, evidence-based instructional practices to support overall student development. By utilizing strategic and intentional instructional practices, other areas such as STEM and employability skills can be integrated with the content standards.

Content-Specific Considerations

The Indiana Academic Standards for Grade 5 Mathematics consist of five domains: Number Sense, Computation and Algebraic Thinking, Geometry, Measurement, and Data Analysis. The skills listed in each domain indicate what students should know and be able to do in Mathematics at each grade level. The Process Standards demonstrate the ways in which students should develop conceptual understanding of mathematical content, and the ways in which students should synthesize and apply mathematical skills.

Acknowledgments

The Indiana Department of Education appreciates the time, dedication, and expertise offered by Indiana's K-12 educators, higher education professors, representatives from business and industry, families, and other stakeholders who contributed to the development of the Indiana Academic Standards. We wish to specially acknowledge the committee members, as well as participants in the public comment period, who dedicated many hours to the review and evaluation of these standards designed to prepare Indiana students for success after graduation.

Mathematics Process Standards

PS.1: Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway, rather than simply jumping into a solution attempt. They consider analogous problems and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" and "Is my answer reasonable?" They understand the approaches of others to solving complex problems and identify correspondences between different approaches. Mathematically proficient students understand how mathematical ideas interconnect and build on one another to produce a coherent whole.

PS.2: Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

PS.3: Construct viable arguments and critique the reasoning of others.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They analyze situations by breaking them into cases and recognize and use counterexamples. They organize their mathematical thinking, justify their conclusions and communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. They justify whether a given statement is always true, sometimes, or never. Mathematically proficient students participate and collaborate in a mathematics community. They listen to or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

PS.4: Model with mathematics.

Mathematically proficient students apply the mathematics they know to solve problems arising in everyday life, society, and the workplace using a variety of appropriate strategies. They create and use a variety of representations to solve problems and to organize and communicate mathematical ideas. Mathematically proficient students apply what they know and are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts, and formulas. They analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

PS.5: Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Mathematically proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. Mathematically proficient students identify relevant external mathematical resources, such as digital content, and use them to pose or solve problems. They use technological tools to explore and deepen their understanding of concepts and to support the development of learning mathematics. They use technology to contribute to concept development, simulation, representation, reasoning, communication, and problem solving.

PS.6: Attend to precision.

Mathematically proficient students communicate precisely to others. They use clear definitions, including correct mathematical language, in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They express solutions clearly and logically by using the appropriate mathematical terms and notation. They specify units of measure and label axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently and check the validity of their results in the context of the problem. They express numerical answers with a degree of precision appropriate for the problem context.

PS.7: Look for and make use of structure.

Mathematically proficient students look closely to discern a pattern or structure. They step back for an overview and shift perspective. They recognize and use properties of operations and equality. They organize and classify geometric shapes based on their attributes. They see expressions, equations, and geometric figures as single objects or as being composed of several objects.

PS.8: Look for and express regularity in repeated reasoning.

Mathematically proficient students notice if calculations are repeated and look for general methods and shortcuts. They notice regularity in mathematical problems and their work to create a rule or formula. Mathematically proficient students maintain oversight of the process, while attending to the details as they solve a problem. They continually evaluate the reasonableness of their intermediate results.

Grade 5 Mathematics

Standards identified as essential for mastery by the end of the grade level are indicated with shading and an "E." The learning outcome statement for each domain immediately precedes each set of standards.

Number Sense	
Learning Outcome: Students explore place value through representing powers of 10 as exponents, modeling percents as parts of 100, and comparing and ordering fractions, mixed numbers, and decimals to the thousandth.	
5.NS.1	Use a number line to compare and order fractions, mixed numbers, and decimals to thousandths. Write the results using > , = , and < symbols. (E)
5.NS.2	Explain different interpretations of fractions, including as parts of a whole, parts of a set, and division of whole numbers by whole numbers.
5.NS.3	Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.
5.NS.4	Model percents as parts of 100 using pictures or diagrams and identify the equivalent fraction.
Computation and Algebraic Thinking	
Learning Outcome: Students apply concepts and strategies of multiplication and division to solve real-world problems. Students add and subtract unlike fractions and use visual fraction models to multiply and divide fractions and whole numbers. Students apply conceptual models and strategies to all operations with decimals to solve real-world problems and represent real-world situations within the first quadrant of the coordinate plane.	
5.CA.1	Find whole-number quotients and remainders with up to four-digit dividends and two-digit divisors using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Describe the strategy and explain the reasoning used. (E)
5.CA.2	Solve real-world problems involving multiplication and division of whole numbers (e.g., by using equations to represent the problem). In division problems that involve a remainder, explain how the remainder affects the solution to the problem. (E)
5.CA.3	Add and subtract fractions and mixed numbers with unlike denominators using strategies or the standard algorithm.
5.CA.4	Solve real-world problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators (e.g., by using visual fraction models and equations to represent the problem). Use benchmark fractions and number sense of fractions to estimate mentally and assess whether the answer is reasonable. (E)
5.CA.5	Use visual fraction models to multiply a fraction by a fraction or a whole number. (E)
5.CA.6	Use visual fraction models and numbers to divide a fraction by a fraction or a whole number. (E)

5.CA.7	Solve real-world problems involving multiplication of fractions, including mixed numbers (e.g., by using visual fraction models and equations to represent the problem). (E)
5.CA.8	Solve real-world problems involving division of fractions and mixed numbers (e.g., by using visual fraction models and equations to represent the problem). (E)
5.CA.9	Add, subtract, multiply, and divide decimals to hundredths, using models or drawings and strategies based on place value or the properties of operations. Describe the strategy and explain the reasoning.
5.CA.10	Solve real-world problems involving addition, subtraction, multiplication, and division with decimals to hundredths including problems that involve money in decimal notation (e.g., by using equations, models or drawings, and strategies based on place value or properties of operations to represent the problem). (E)
5.CA.11	Represent real-world problems and equations by graphing ordered pairs in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

Geometry

Learning Outcome: Students use appropriate tools to investigate attributes of triangles and circles.

5.G.1	Identify, describe, and draw triangles (right, acute, obtuse) and circles using appropriate tools (e.g., ruler or straightedge, compass, and technology). Define and model the relationship between radius and diameter.

Measurement

Learning Outcome: Students investigate the volume of rectangular prisms and solve real-world problems through the development and application of area formulas for rectangles, triangles, parallelograms, and trapezoids. Students investigate and convert measurements within the Customary and metric measurement systems.

5.M.1	Convert among different-sized standard measurement units within a given measurement system and use these conversions in solving multi-step, real-world problems.
5.M.2	Find the area of a rectangle with fractional side lengths by modeling with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.
5.M.3	Develop and use formulas for the area of triangles, parallelograms, and trapezoids. Solve real-world and other mathematical problems that involve perimeter and area of triangles, parallelograms, and trapezoids, using appropriate units for measures. (E)
5.M.4	Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths or multiplying the height by the area of the base. (E)
5.M.5	Apply the formulas $V = l \times w \times h$ and $V = B \times h$ for right rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths to solve real-world problems and other mathematical problems. (E)

Data Analysis	
Learning Outcome: Students create questions appropriate to the data and answer the questions using multiple representations.	
5.DA.1	Formulate questions that can be addressed with categorical and numerical data and make predictions about the data. Collect, organize, and graph data from observations, surveys, and experiments using line plots with fractional intervals, histograms, or other graphical representations that appropriately represent the data set. (E)
5.DA.2	Calculate measures of central tendency (mean, median, and mode) to describe a data set. Analyze data sets to determine which measure of central tendency appropriately describes the distribution of data. (E)